

BEHAVIOUR OF LARVAL AND ADULT *LEUCOPIS* (DIPTERA: CHAMAEMYIIDAE)

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INTRODUCTION TO THE FAMILY CHAMAEMYIIDAE

The Chamaemyiidae comprise over 200 described species worldwide, with about half of these known from the Palaearctic Region (Tanasijtshuk, 1984). There are estimated to be around 40 species in Britain, including some recently discovered awaiting description and naming by the author of this paper. There are likely to be many undescribed species in other faunal regions because the family has received relatively little taxonomic or ecological investigation outside the Palaearctic.

Members of this family have been called 'silver-flies' (e.g. McAlpine, 1977 citing the originator of the name, Tanasijtshuk, 1970) because many species have a densely dusted silver-grey body coloration, though black or even yellowish colours are also found in some foreign Chamaemyiidae.

BIOLOGY OF LARVAE

Chamaemyiidae larvae are specialized predators of Homoptera such as aphids, scale insects and woolly aphids, while an undescribed British species consumes nymphs of a gall-forming psyllid (McLean, in prep.). In the tropics more species are likely to be associated with scale insects because these Homoptera are more abundant there, whereas aphids are more frequent and rich in species in temperate zones (Dixon, 1985). Some Chamaemyiidae have been accidentally or deliberately introduced outside their natural range in association with their prey. Those species preying on woolly aphids have received the greatest attention as potential biocontrol agents, with some species having been purposely introduced to North America (e.g. McAlpine, 1971).

The larvae have a body form similar to aphid-feeding hoverflies (Syrphidae) but differ due to the presence of two widely separated posterior spiracles (hoverflies have the posterior spiracles fused into a single tube). Typically Chamaemyiidae larvae are coloured white or yellow, sometimes with the internal organs partly visible through the integument. The body surface may be covered with spinules, papillae and tubercles and can be coated with a waxy material (notably in *Leucopis argentata* Heeger (= *concordata* McAlpine & Tanasijtshuk) among British species).

Those *Leucopis* which feed on free-living aphids specialize in attacking colonies of ant-attended aphids. These form densely aggregated colonies, with the individual aphids being sluggish rather than agile in their movements, and they are therefore more readily captured by the small (less than 4 mm long) *Leucopis* larvae which are unable to move with the speed or over the distances achieved by larger hoverfly larvae. Larvae can hoist aphids clear of the plant surface, thereby reducing the likelihood of the prey escaping and at the same time giving the appearance of a seal balancing a ball on its nose! Similar behaviour has evolved independently in larvae of aphid-feeding hoverflies. Furthermore, the small, slow-moving *Leucopis* larvae are ignored by ants which, however, will attack and remove larger aphid predators such as hoverfly larvae or ladybirds.

BIOLOGY OF ADULTS

Adult Chamaemyiidae are seldom seen away from colonies of their prey and have not been observed feeding at flowers. They have a distinctive 'trundling' gait when walking and have an amazing facility for avoiding the aggressive attentions of ants

guarding aphid colonies. An adult *Leucopis* will neatly move forwards, backwards or sideways as an ant approaches, leaving the aggressor with the appearance of being perplexed and confused as the fly rapidly disappears! Adult *Leucopis* fly towards aphid colonies with an oscillating line of flight characteristic of insects flying down the concentration gradient of an airborne chemical, suggesting that they may be attracted by the colony odour. The response may be to pheromones produced by the aphids; for example, highly aggregated aphids are known to produce low levels of trans- β -farnesene as a means of keeping the colony together; this substance is also emitted in greater amounts as an alarm pheromone when these aphids are attacked by predators (Dixon, 1985).

Adults will feed on the sugary excretions (honeydew) of their prey which coat leaf surfaces, but additionally an interesting behavioural adaptation, first observed by the distinguished Russian specialist on Chamaemyiidae Dr V. N. Tanasijtshuk (see Tanasijtshuk (1986) figs 675 and 678), enables more efficient feeding on honeydew. The behaviour consists of the adults 'milking' aphids for honeydew, using their fore tarsi to stroke the dorsal surface of the aphids.

The female *Leucopis* illustrated (Plate I, Figure 4) is poised over an aphid while exhibiting this behaviour. The aphid species is *Aphis farinosa* Gmelin on the tip of a sallow shoot (*Salix* species). The aphids typically will produce honeydew when stimulated by attendant ants stroking them, and the *Leucopis* adults mimic this stimulus very effectively using their fore tarsi. Many of those aphids 'massaged' by adult *Leucopis* produce a drop of honeydew, which is then rapidly consumed when detected by chemoreceptors on the fly's tarsi. Because Diptera have the capacity to detect sugars via sensors on the tarsi a relatively small series of evolutionary steps can be postulated for adult *Leucopis* first to detect and feed on honeydew on leaves, secondly to come into contact with more honeydew when walking over aphid colonies, and thirdly to discover it is then possible to increase the amount of honeydew released by stroking the aphids using the fore tarsi.

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BOOK NOTICE

Bees of the world, by C. O'Toole and A. Raw. London, Blandford (Cassell), 1991, 192 pp, £18.95, hardback.—The latest in the '... of the world' series, this book is lavishly illustrated with bright crisp photographs and expertly narrated in very readable prose. With an emphasis on behaviour and ecology rather than systematics, it makes easy and informative reading for the expert or novice alike.